Field
of America II

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Allen, Timothy Field
The Characeae of America
1888-1896

Part II:

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The Characeæ of America.

By Dr. T. F. ALLEN.

PART II.

FASICLE I.: CONTAINING DESCRIPTIONS AND ILLUSTRATIONS OF

NITELLA OPACA, AG.

NITELLA OBTUSA, ALLEN.

NITELLA MONTANA, ALLEN.

NITELLA BLANKINSHIPII, ALLEN.

NITELLA MISSOURIENSIS, ALLEN.

NITELLA FLEXILIS, AG.

NITELLA SUBGLOMERATA, A. BR.

NITELLA GLOMERULIFERA, A. BR.

Revised Synopsis.

A. MONARTHRODACTYLÆ, (ultimate segments of the leaves, one-celled.

a. FURCATÆ, leaves once divided.

a. HOMŒOPHYLLÆ, verticils composed of similar leaves.

* GYMNOCARPÆ, organs of fructification not enveloped in jelly.

§ DIOICÆ.

† APICULATÆ, leaves abruptly pointed, or sometimes (in No. 2) obtuse, coronula, evanescent.

1. Membrane of the spore smooth.

N. opaca, Ag.

2. Membrane of the spore granulated.

N. obtusa, Allen.

†† ACUMINATÆ, leaves gradually tapering to a sharp point, coronula persistent.

\+ Plants small,

3. Oospores aggregated, **N. Montana,** Allen.

4. Oospores, isolated, **N. Blankinshipii,** Allen.

++ Plants large, habit of N. *subglomerata.*

5. **N. Missouriensis,** Allen.

§§ MONOICÆ.

† APICULATA, coronulæ evanescent.

6. **N. flexilis,** Ag.

†† ACUMINATÆ, coronulæ persistent.

**General variations*, common to many species of Nitella. Variations in the internodal cells of the principal stem give rise to elongated and compact forms. In the latter the distance between verticils becomes so small that the fruiting verricils are condensed into "heads," as in *N. glomerulifera*, when less compact, but still dense, forms called "*nidifica*" *conglomerata* or "*compacta*" are found. It is noticed in general that, when portions of the plant fruit freely, the stem is not so well developed and frequently the leaves become shorter. Sterile plants are apt to be more diffuse in their habit. In some cases, as in the new *N. obtusa*, the internodal cells are elongated, but the leaves of the verticils, especially the fertile ones, are quite abbreviated. In such cases the form may be called "*conglobata.*" Again, the segments of the leaves may be disproportionately elongated or contracted. All these and other variations are to be expected in the same species, and must not be taken as specific distinctions but as simple variations or forms. The markings on the membrane of the oospore are most important in distinguishing between species and varieties, since, as shown by Dr. Nordstedt, they are constant for each species. They may be known as Nordstedt's markinsg.

7. Sterile leaves not much longer than the fertile verticils. **N. subglomerata,** A. Br.

8. Sterile leaves much longer than the fertile verticils, which are contracted into dense heads. **N. glomerulifera,** A. Br.

* * Glœcarpæ, organs of fructification enveloped in jelly.

§ Dioicæ.

9. Habit diffuse, fruit in spring, membrane of nucleus covered with course granules, **N. Capitata (N. ab. E.),** Ag.

10. Habit strict, rigid, fruit in fall, membrane of nucleus delicately reticulated. **N. Bastini,** Allen.

§ § Monoicæ.

11. **N. prælonga,** A. Br.

aa. Heterophylla, verticils composed of dissimilar leaves, some simple, some divided.

12. **N. Clavata,** A. Br.

aa. Flabellata. Leaves repeatedly divided.

13. **N. Macounii,** Allen.

Nitella Opaca, Ag. Syst. Alg. (1824) p. 124.

N. syncarpa v. opaca A. Br., Flora 1835 ; Kuetzing Phycol. germ : Rabenhorst Crypt. Fl. II. p. 195

N. syncarpa v. pseudoflexilis A. Br. Flora 1835 : Ganterer aust. Char. : Rabenh. Crypt. flora.

N. syncarpa v. glomerata A. Br. schweiz. char. : Kuetzing sp. Alg. p. 514

N. syncarpa v. Smithü, Cosson. Germ. et. Weddell Introduct. Fl. de Paris 1842 : Coss. et. Germ. Fl. de Paris, Atlas t. 39

N. pedunculata Ag. Syst. Alg. 1824 p. xxvii

N. atrovirens Wallm. Char. 1853

N. flexilis Smith Engl. Bot.

N. flexilis v. nidifica, Visiani Fl. Dalm.

Very variable in size, from 5 to 30 cm. in length ; elongated and loosely spreading or abbreviated, and compact according to the depth of water or season of the year. Cell-walls generally firm and somewhat thicker than in *N. flexilis*, which it resembles in habit ; the dried plants darker and less translucent (hence the name, *opaca*). Verticils composed of six or seven leaves, which are all once divided into two or three terminals

(rarely only one). Leaves *abruptly pointed*. It has been thought that this species was peculiar, in that the "lumen" extended into the very point, but the tips vary in the leaves of the same plant, so that this peculiarity cannot be considered a constant characteristic of the species. The fruit appears later than that of *N. flexilis*, and is less frequently found; it differs from this species also by being *diœcious*. Antheridia, variable in size, rarely exceeding 800 μ. in diameter. Oogonia usually aggregated (1 to 3); tips of the enveloping cells becoming swollen; coronula evanescent; mature oospore nearly or quite black (thin sections reddish under the microscope), with 6 or 7 prominent and thick ridges (striæ), 34 to 36 μ long, 30 to 34 μ broad. The spores are mature in July or August. *The surface of the mature nucleus is perfectly smooth, even under high amplifications.*

Localities.—This species has been collected in Canada, Macoun; So. Framingham, Mass., Dr. Sturtevant (only antheridia seen; hence determination doubtful); New Hampshire, Saco Lake and Ammoneesie River (E. Faxon), notch of White Mountains (O. D. Allen); New York, Edmunds ponds, Adirondacks (T. F. Allen); Pennsylvania, Lehigh River (E. A. Rau); California, San Bernadino (Parish Bros.); Oregon, Salem (E. Hall); Nevada, Truckee Valley (S. Watson); Louisiana (Drummond); Texas (Lindheimer); Mexico (Linden, 1840).

Explanation of Plates.—The photograph is from an elongated and loose form collected in Saco Lake, N. H. (Faxon), natural size. The lithograph shows at 1, a plant of natural size, somewhat condensed above; 2, aggregated oogonia, showing the swollen tips of the enveloping cells, coronula already fallen, x 25; 3, antheridia, x 25; 4, nucleus, with 7 prominent and thick ridges, x 50; 5, a minute portion of the surface of the membrane of the ripe oospore, highly magnified; surface between ridges *smooth*. (The leaves in Fig. 3 are somewhat acuminate; this is rarely the case; the tip in Fig. 2 shows the normal shape).

Nitella Obtusa, *Spec. nov.*—*N. monarthrodactyla, homœophylla, dioica, gymnocarpa, foliis apiculatis vel obtusis, membrana oosporæ granulata.*

Description.—Plants densely tufted, 20 to 25 cm. in height, leaves of the lower verticils, sterile longer than the internodes, 3 to 5 cm. long, verticils composed of six (or seven) leaves; leaves all similar, once divided, terminal leaflets of sterile leaves,

1 to 3, abruptly pointed, *sometimes obtuse*. Leaves becoming shortened in the upper verticils forming a long terminal stem, about 700 μ in diameter, with very short leaves in remote verticils; these upper leaves are fertile and *commonly obtuse*, rarely apiculate. Fertile leaves once divided, first division 400 to 500 μ in diameter, with one terminal 700 μ in diameter, rarely two terminals. Antheridia, about 250 μ in diameter, usually subtended by a very short, abtuse leaflet (see figs. 4 and 5). Oogonia, single or aggregated, enveloping cells with blunt, usually inflated tips, coronula evanescent; oospore 460 μ long, 400 μ broad with seven, thick and prominent ridges, *membrane of the oospore granulated.*

This plant was first gathered by the late Dr. Northrup and his wife in Lake Tamiscouata, Canada; but a single specimen was taken, and a special collector sent to the lake two years since failed to gather but few complete specimens, though he secured a number of detached, fruiting, terminal stems which had drifted to a lee shore. Fruit mature in August.

Explanation of Plates.—The photogravure was taken from Dr. Northrup's collection, and is one-half the natural size; in the lithograph, 3, the female plant, x 25; 4, the male plant, x 25; 5, tips of fertile leaves, x 25; 6, an oogonium, x 50; 7, a portion of the spore-membrane highly magnified, showing the closely-granular surface and a portion of a thick ridge; 8 and 9, apiculate terminals, x 25; 10, an obtuse terminal, x 50 diameters.

Nitella Montana, Sp. nov.—*Monarthrodactyla*, *furcata*, *homœophylla*, *dioica*, *gymnocarpa*, *acuminata*.

Plants small, from 3 to 7 cent. metre high, branched and delicate; the upper verticils fertile. Leaves 8 in a verticil, once divided; terminal divisions, 1–3, gradually acuminate. In the verticils may be found additional very short leaves (shoots) fertile, so short that the fruit seems almost sessile in the verticil. The stems are about 600 μ. in diameter; the first division of the leaves, 350 μ., and the terminals about 200 μ. in diam., tapering to a sharp point. The oogonia are numerous, 1–3 together at the forks of the leaves; coronula persistent; oospore when mature, 440 μ. long; 390 to 400 μ. broad, with 7 or 8 somewhat blunt ridges (not so thick as the ridges on N. opaca); membrane of the spore *finely and evenly granular*. Antheridia, 750 μ. in diam., when fully developed.

This delicate and pretty plant was first sent to me from Crater Lake. Mt. Agassiz, gathered by U. S. Geol. Survey.

Later by Mr. Williams from Sand Coulee, Montana.

Explanation of Plate.—1, plant natural size; 2, male plant, x 25; 3, female plant, x 25; 4 a mature oospore, x 50; 5, a portion of the finely granulated membrane of the spore highly magnified.

NITELLA BLANKINSHIPII, Sp. nov.—*Monarthrodactyla, fureata, homœophylla* (*rarius heterophylla*), *dioica gymnocarpa, acuminata.*

Plant delicate, not over 5–10 cm. high, branched above. Leaves eight in a verticil, once divided, all similar, except in rare instances heterophyllous (see figure 2); leaves with very thin walls, with a slight tendency to become dilated; first segment 300 μ. in diam.; terminal segments, two to four, 150 μ. in diam. Oogonia usually *single*; coronula, persistent; oospore, 450 μ. long; 400 μ. broad, with 6 (*to* 7) *sharp and prominent ridges;* membrane of the spore roughened by *scattered* granules not uniform in size (of uniform size in N. Montana). Antheridia, 600 μ. in diam.

This little nitella was gathered in Missouri by Mr. Blankinship (an enthusiastic collector of characeæ); it has been found only in one locality.

It is interesting to observe the occasional variation of heterophyllous leaves, since in other respects it bears some resemblance to *N. clavata* of the Pacific coast; this species, however, is separated from that by being diœcious and commonly homœophyllous.

Explanation of Plate.—1, plant, natural size; 2, two verticils showing different sorts of leaves (rare); 3, an ordinary sterile verticil; 4, an antheridium; 5, an oogonium separated from its leaf; 6, oospore; 7, membrane of oospore highly magnified. Figs. 2, 3 and 4 magnified 25 diam, figs. 5 and 6 mag. 50 diam.

NITELLA MISSOURIENSIS, N. SP.—Plant diffusely branched 15-20 em. in length, in size and appearance resembling *opaca*, or, still more, *subcapitata*; to the latter it would be unhesitatingly referred, except for the fact of being *entirely devoid of a gelatinous envelope about the fruit.* Mature spores have not been gathered, and their characters and markings cannot be noted; the coronula of the oogonium seems to be persistent (as usual in the section "*acuminatæ*,") the ridges on the spore few (5). Antheridia 650 μ. in diameter. The two (only) specimens found were gathered in April (season of subcaptata), near Springfield, Missouri, by

Mr. Weller. This imperfect description is published with hesitation, but since the plant evidently belongs in this group, it seems best to refer to it here. The figures speak for themselves, all x 25. The photogravure represents the plant of natural size.

NITELLA FLEXILIS (L., *ex parte*), Ag.

Chara flexilis, L., *ex parte*.

Nitella flexilis, Ag., syst. Alg., 1824.

Nitella Brogniartiana, Coss, Germ., *et.* Wedd. Fl., Paris.

This very common species, while variable as to size and manner of growth, may be recognized easily by being gymnocarpous monœcious, and having abruptly pointed leaves. It varies greatly in size, from a few cm. to as much as 75 cm. and perhaps more in length. In brooks it often forms dense masses or hummocks with rather short stems ; in deeper and slow-flowing streams the stems may become excessively elongated. The stems and leaves are variously abbreviated, particularly in fruiting specimens, and sometimes, as in Fig. 2 of the plate, the fruiting leaves become densely crowded, vars. nidifica, subnidifica, etc. The verticils are composed normally of six leaves, each leaf is once divided into 1-4 terminals, *usually two*, rarely only one ; the tip of the leaf is abruptly short-pointed, at times almost blunt, never entirely so. Antheridia about 450 μ. in diam.; oogonia, with an evanescent coronula, generally aggregated (1 to 3 on one node); oospore about 425 μ. long, 375 μ. wide, with 6-7 ridges, which are usually sharp, not thick as in N. opaca : membrane of the spore perfectly smooth.

This species is our most common nitella, found everywhere from the Atlantic to the Pacific, north and south, though at the south it is partly replaced by the larger N. *prælonga*, A. Br. This species flourishes well in aquaria, and its vigor and clean bright stems make it useful for showing the phenomenon of cyclosis.

A form with stouter stems and shorter leaves, *var. crassa*, is now and then met with, but it is usually sterile; a thick autumnal form with but a single terminal, also sterile is sometimes puzzling when sterile.

In the plate, Fig. 1, half the natural size ; Fig. 2, a compact form, natural size, forma subnidifica, well-fruited, from California, Blankinship, Figs. 3-6 x 50; Fig. 7, surface of the smooth spore, showing parts of two sharp ridges highly magnified. Photogravures half the natural size, " 11," a more rigid specimen,

not usual, terminals usually single, whole plant stouter and less flexible.

NITELLA SUBGLOMERATA, A. Br.—Nitella subglomerata, A. Br., *Characeen aus Colombia Guyana and Mittelamerika*, 1858 (Monatsbericht d. Berl. Akad). Later N. acuminata var. subglomerata, A. Br.

"*Acuminatae*" must be utilised as the name of a group, both of monoccious and dioecious species, and it seems best to adopt A. Braun's former opinions, and keep the species distinct, a position which it is clearly entitled to hold.

This species is essentially southern, and particularly southwestern, found chiefly from Missouri to Mexico, though stray specimens are reported from Ills., and even New Jersey and New York. The plant is spreading, and diffusely branched, verticils of 6 to 8 leaves, leaves once divided into 2 to 4 terminate, which gradually taper to a sharp point. *The fruiting verticils are somewhat contracted, forming a rather compact mass*, but not dense as in the following species (hence the name): 1, Antheridia, about 300 μ. in diameter; oogonia, usually aggregated (2 to 3), with persistent coronulae; spores, about 275 μ long by 240 μ wide, with 6 or 7 sharp ridges, which are somewhat prominent. Membrane of the spore, roughened or reticulated, only seen in mature oospores.

This species has been gathered in the Saranac Lake, N. Y. T. F. Allen; Shamokin, Penn.; New Jersey, T. F. Allen; various localities in Illinois, especially along the Mississippi River region, Patterson, Aug., '81; in Missouri at various periods in March, Weller; Sept., Blankinship, Oregon; Sauvies Island, Howell; Texas, Lindheimer; seven localities in Mexico.

VAR. BRACHYTELES, A. Br.—Characterized by greatly abbreviated terminal segments of the leaves, first described from specimens found near St. Louis; recently sent me by Mr. C. Mohr., from the delta of the Mobile River, Alabama.

N. LINDHEIMER, A. Br., characterized by A. Braun, is very closely related to N. Belangirl, A. Br., of the East Indies (Bombay, etc.), "larger than the forms of sub*glomerata* from Illinois and St. Louis." I have seen but one imperfect speciman in the Engelmann herbarium, and cannot discover any essential difference from the typical *subglomerata*. The oospores are of the same size, and the membrane marked exactly in the same way. We are obliged to wait for the re-discovery of the plant to illustrate it, gathered by Lindheimer at Friedricksburg, Texas.

In the Lithograph Nos. 1 and 2 mag., 25 diam. No. 3 x 50 diam. The photogravure half the natural size.

NITELLA GLOMERULIFERA, A. Br. Sillim. Am. Journ., 1843, p. 92, name only.

Plants 10 to 15 cm., high, growing in clusters at the bottom of clear, still lakes, often at a considerable depth, easily recognized by the dense masses of fruiting verticils which are collected in *glomeruli*, attaining a diameter of 8 or 10 mm., and are subtended by simple or once-branched sterile leaves; which long overtop the glomeruli; sterile leaves often 40 to 40 mm. in length; once-divided; terminals 2-4, one-third to one-half the whole length of the leaf; gradually tapering to a sharp point.

Fertile verticiles arise, usually, in the "axils" of the sterile leaves, generally numerous and becoming repeatedly branched and abbreviated form dense masses; *glomeruli* often 10 mm. in diameter. Leaves of the fertile verticils 8 in number, about 2 mm. long, of which about half is taken by the terminals, 2 to 4, rarely 5, in number. Antheridia about 400 μ in diam.; coronulæ persistent; oospore 400 μ long, 300 μ broad with seven ridges, not prominent; membrane of the oospore thickly studded with roundish elevations or granules; these granules average 1.5 μ in diam. (5 granules with their spaces in 15 μ). The markings on the oospore clearly separate this species from all the others of this section, though the plant is clearly and strikingly distinct in other ways.

The first specimens appear to have been collected in the Merrimac River, Mass., by Green. Since then in Massachusetts, several places, Farlow, etc., New York, Lake Champlain, Morong; Lake Ontario, Allen; New Jersey, Allen; Chatauqua Lake, Allen; Ohio, Peck; Louisiana, in March, 1836, Dr. Carpenter, etc., etc. Its range thus seems large, but it appears to be a more northern than southern species (the reverse of *subglomerata*).

Explanation of Plate: 1 x 25, a fruiting plant "glomeruli" not large nor dense, rather immature; 2 x 25, a portion of a glomerulus, showing only a single stem of a fruiting verticil, and at "bb" the remains of sterile leaves; 3, a mature oospore x 50; 4, a bit of the membrane of the oospore highly magnified.

Nitella subglomerata, A. Br.

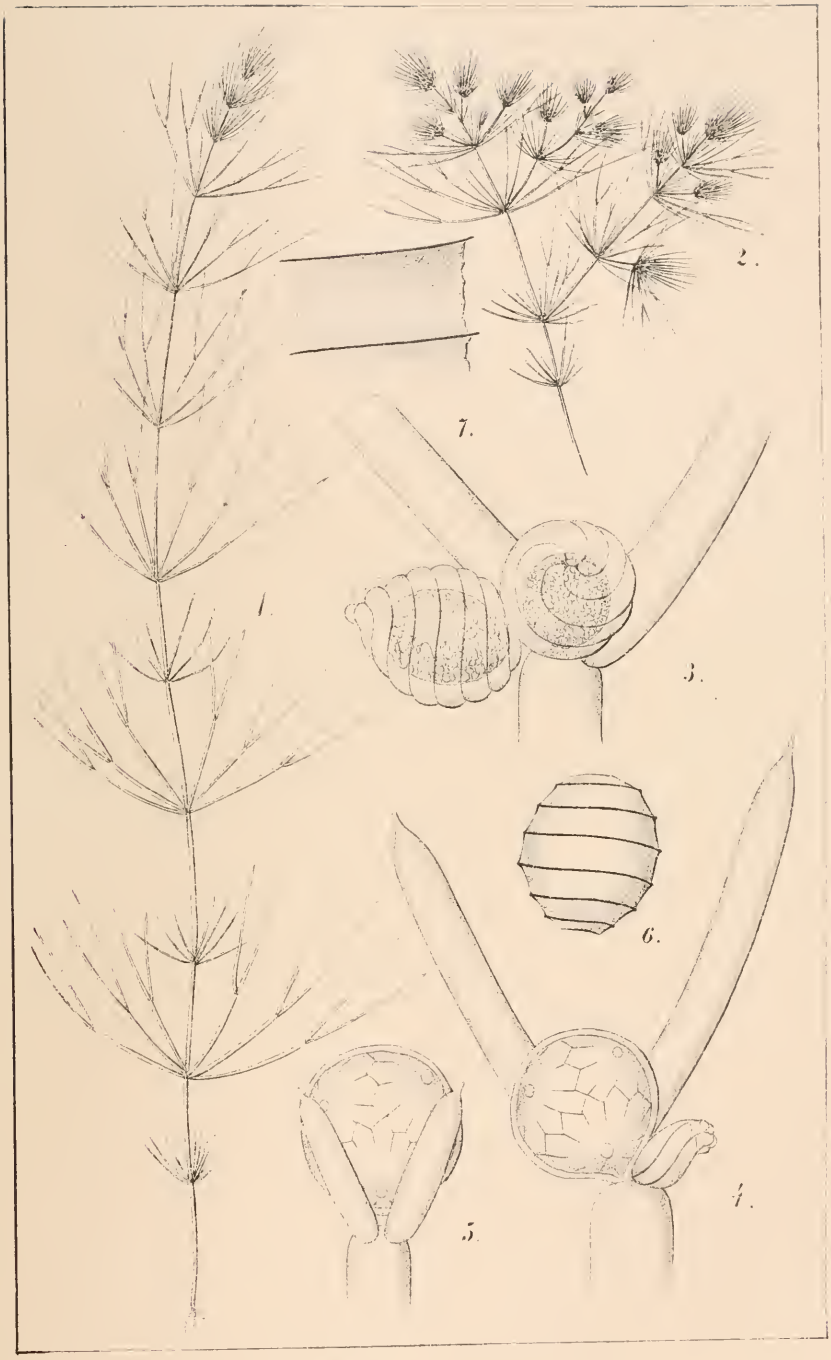
Nitella obtusa, Allen.

Nitella opaca, Ag.

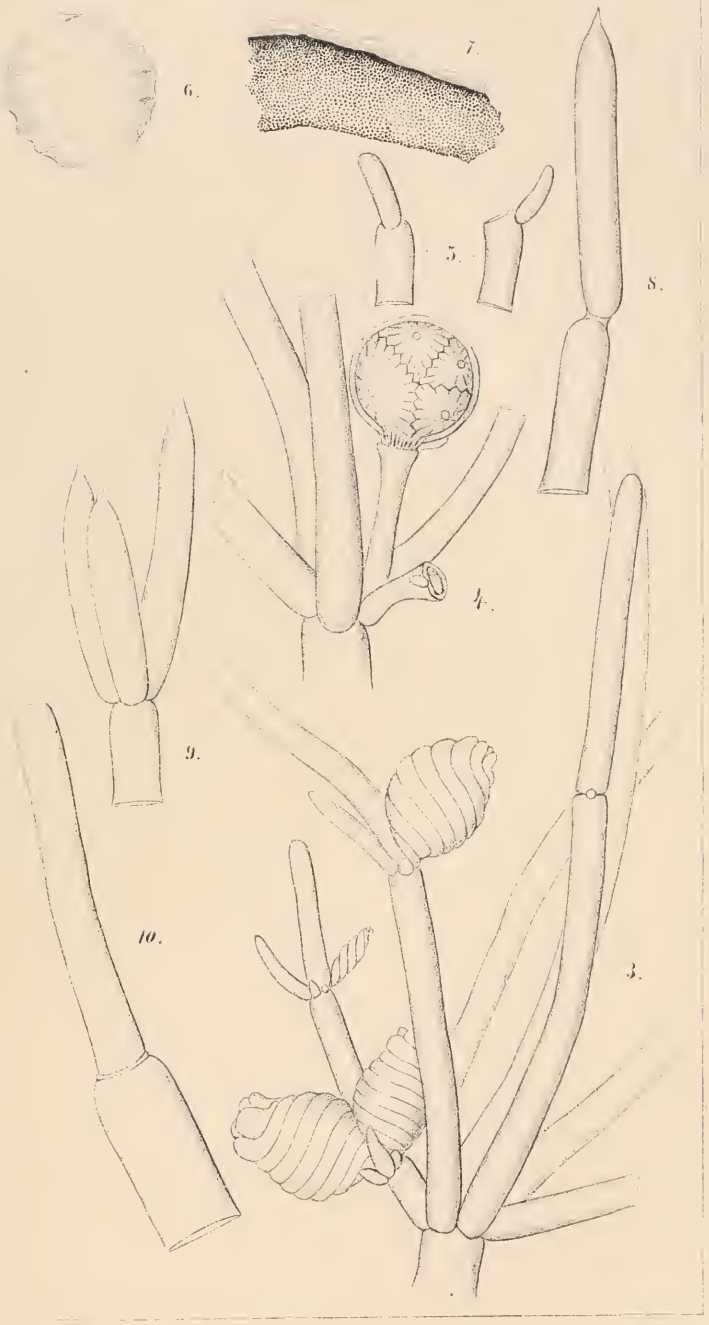
Nitella flexilis, Ag.

Nitella missouriensis, Allen.

Nitella glomerulifera, A.Br.

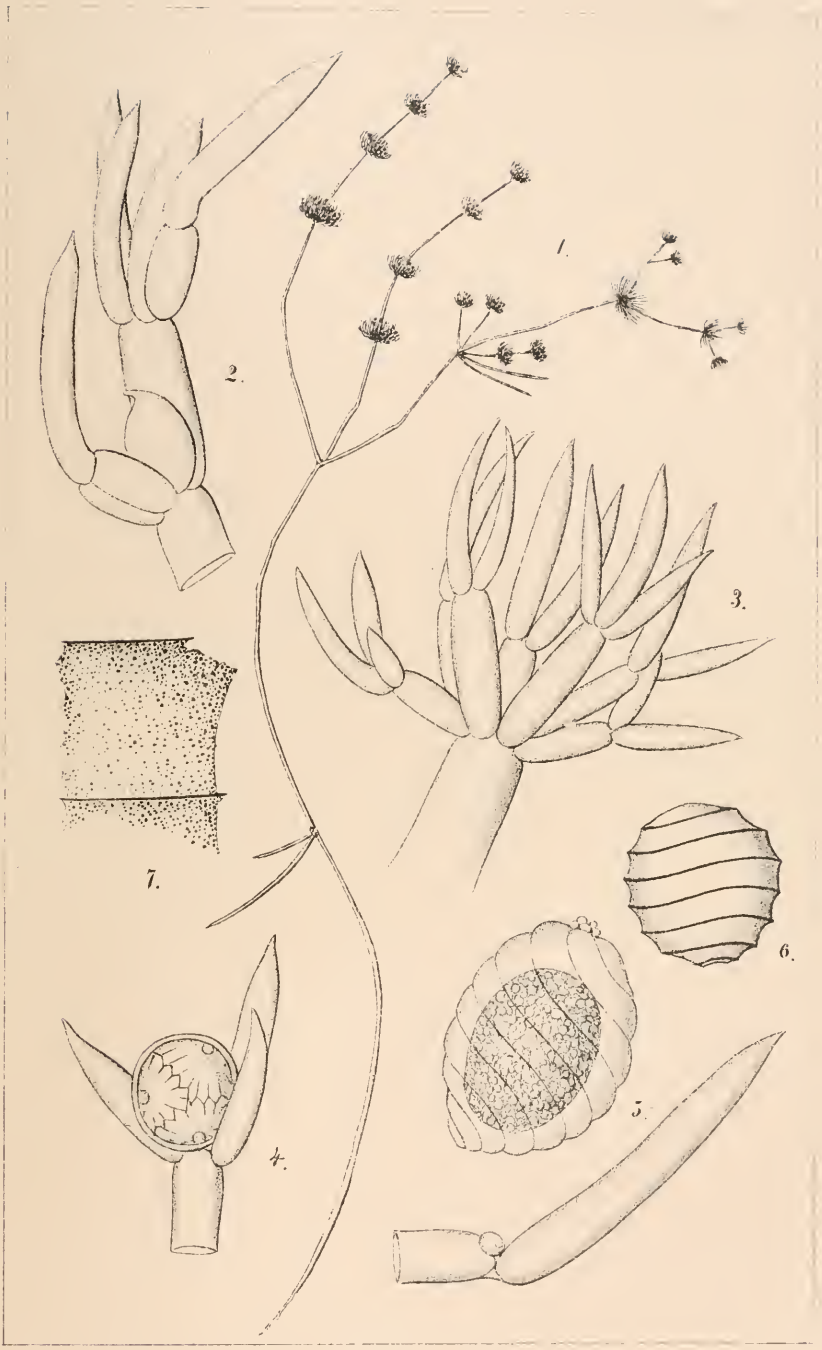


Nitella flexilis. Ag.

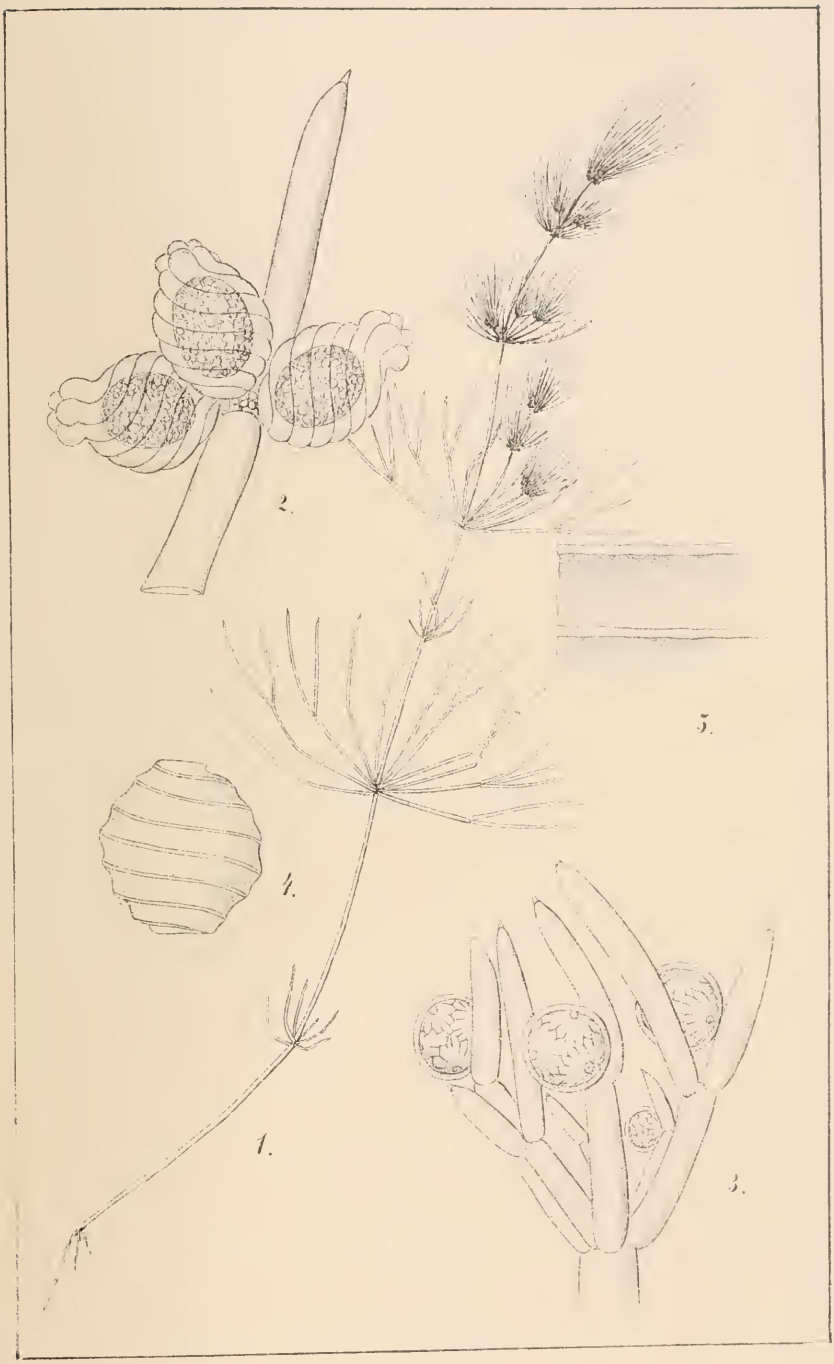


Nitella obtusa. Allen.

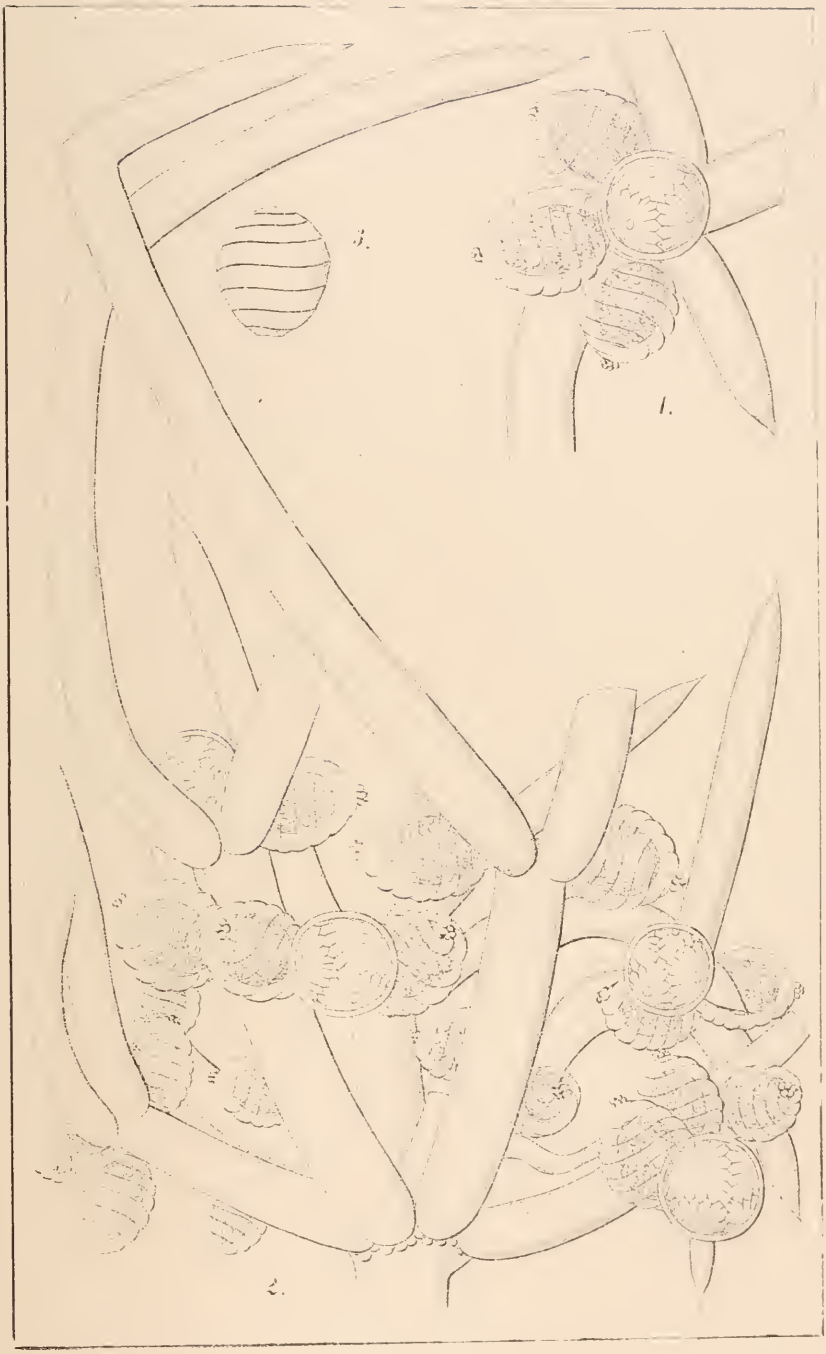
Nitella montana, Allen.



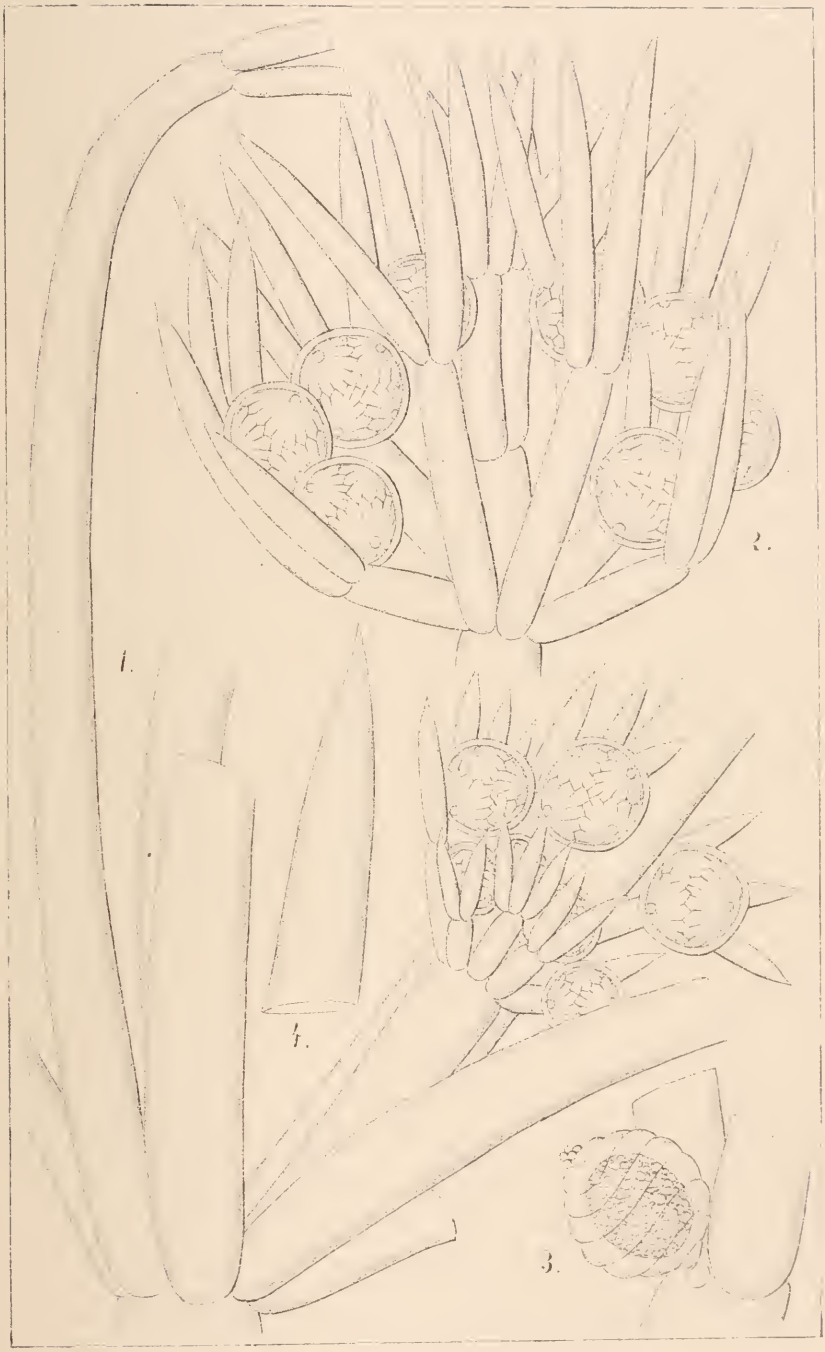
Nitella Blankinshipii, Allen.



Nitella opaca, Ag.



Nitella subglomerata, A.Br.



Nitella missouriensis. Allen.

ADVERTISEMENT.

The second part of this work will comprise descriptions and illustrations in the form of lithographs and photo-gravures of all the known species of Characeæ growing in America. It will be issued in fasicles, each to contain descriptions of eight species and as many illustrations as may be needed. The text will describe American species in the order of classification, but the frequent coming to light of new species will doubtless require the issue of supplementary numbers, to which also it will be necessary to refer the description of South American species, for which we await new collections. The Price of each part will be $1.00.

EXSICCATÆ, to continue former issues will be distributed, as far as collections will permit, to accompany these illustrations.

T. F. ALLEN,

No. 10 EAST 36TH ST., NEW YORK CITY.

The Characeæ of America.

By Dr. T. F. ALLEN.

PART II.

FASICLE II.: CONTAINING DESCRIPTIONS AND ILLUSTRATIONS OF

NITELLA CAPITATA (N. AB. E.) AG.
NITELLA BASTINI, SP. NOV.
NITELLA PRÆLONGA, A. BR.
NITELLA CLAVATA (BERTERO), A. BR.
NITELLA DILATATA, SP. NOV.
NITELLA MACOUNII, ALLEN.
NITELLA AXILLARIS, A. BR.
NITELLA MORONGII, ALLEN.
NITELLA ANNULARIS, SP. NOV.

ISSUED DECEMBER 1894.

Synopsis, revised and continued from page 2.

* * GLŒOCARPÆ

§ Dioicæ, Habit diffuse, fruit mature in early spring or summer, membrane of spore covered with coarse granules, 9, **Capitata**, (N. ab. E.), Ag.

— Habit strict, rather rigid, fruit in late summer or fall, membrane of spore delicately reticulated, 10, **N. Bastini**, Allen.

§ § Monoicæ,

11. **N. prælonga**, A. Br.

aa. Heterophyllæ (verticils composed of dissimilar leaves, some simple, others divided),

Verticils truly heterophyllous; membrane of oospore granulated,

12. **N. clavata**, A. Br.

Verticils not truly heterophyllous (sterile leaves only simple or at times divided); oospore smooth.

13. **N. dilatata**, Allen.

aa. Flabellata (leaves repeatedly divided).

14. **N. Macounii**, Allen.

B. Diarthrodactylæ (ultimate segments of the leaves two-celled, the terminal cell mucroniform).

a. Homœophylllæ.

§ Dioicæ (no species yet known in America).

§ § Monoicæ.

† Macrodactylæ (leaves divided once, twice of thrice; ultimate divisions not disproportionately abbreviated).

× Sub-Flabellatæ (leaves once or twice divided, compare "××").

* Gymnocarpæ. Fruit not enveloped in mucus.

! Congestæ (fertile verticils contracted, in axillary and terminal "heads."

+ Sterile leaves terminating in a single mucronate cell (?).

15. **N. Morongii**, Allen.

+ + Sterile leaves surmounted by a crown of two-celled leaflets.

1. Small, fertile verticils terminal and axillary, lower cells of the terminal leaflets inflated, short.

16. **N. axillaris**,

2. Larger, fertile verticils terminal, lower cell of the terminal leaflets elongated, not inflated.

17. **N. annularis**, Allen.

Nitella Capitata (N. ab. Es.) A., 1824.

Synonyms, Chara capitata, N. ab es, 1818: (Chara capillaris Krocker, Fl. Siles, 1814; name and species uncertain, name applied to different species). Chara botryoides, Krocker; Chara elastica,

Amici, 1827; Chara flexilis vars. acarpa and ramentacea, Wallr, 1833; Ch. syncarpa var. capitata Gant, 1847; Chara glomerata, Bischoff, 1828; Chara gracilis, Wahlenberg, 1826; Chara gracilis vars. epicarpa and syncarpa, Wallr; Nitella syncarpa var. oxygyra, A. Br., 1847; N. syncarpa vars. capitata and glœocephala, Kuetzg. .

This plant usually attains a length of 20 to 30 cm., is much branched, very flexible, bright green, rarely incrusted. Fruiting as it does early in the spring, it disappears early in the season; it is found in clear spring water. The leaves, usually eight in each verticil, are once forked; the terminal segments are one-celled and abruptly pointed. The fruit develops at the nodes of the leaves. The oogonia are aggregated, usually two or three. The coronula is evanescent. The oospore is nearly round, marked when mature by six prominent and sharp ridges, 280 to 360 long, the surface coarsely granulated. The antheridia are about 600 in diameter. All the fruiting organs are thickly enveloped in jelly.

This species, which is common and very variable in Europe, has been met with in America only in Cambridge, Mass., 1867 (Boot), and on Long Island, New York, in 1870, by the writer. Repeated search in the cold streams near Hempstead, L. I. (the original locality), has failed to re-discover the plant. The form then found was long-leaved, slender and immature. It is to be looked for in May in clear, cold brooks.

Nitella Bastini, sp. nov.—*Nitella monarthrodactyla, furcata, homœophylla, glœocarpa, dioica.*

Plants 2 to 3 cm. high, quite rigid, with verticils of rather short leaves, 8 to 12 in a verticil. Leaves all once—divided. In the female plants the leaves are rather longer and larger than in the male; in the female the first segment averages 2675 long by 320 broad; in the male 1500 long, 215 broad. The terminal segments, two in number, are 150 to 400 long, 120 broad, rather abruptly acuminate.

The fruit of both sexes is enveloped in mucus and in some cases appears to be stipitate, especially when, as often noticed, it is found within a verticil, at the base of the leaves.

Antheridia 600 to 625 in diam.; oogonia aggregated, oospores 265 to 300 long, 235 to 250 broad; ridges 7 to 8; surface beautifully reticulated.

This new and very distinct species was gathered by Prof. Bastin, of Chicago, near that city, on the site of the World's Fair (the original locality is destroyed).

The plants seem quite rigid, sometimes encrusted and even brittle. While the synopsis associates it with the preceding species, it has no

apparent relationship to it, being similar chiefly in being dicœcious and having fruit enveloped in jelly.

Explanation of Plate.—Fig. 1, female plant more elongated and diffused than Fig. 2, a male plant more contracted; Fig 3, male terminals x 25; Fig. 4, female terminals x 25; Fig. 6, oospores x 50; Fig. 5, surface of same highly magnified.

N. Prælonga, A. Br.—Die Characeen Afrika's, Berlin, 1868 (name only); description in Braun-Nordstedt "Fragmenta" etc., 1882, with figures. (N. gelatinosa v. gigantea, Halsted, Charac. Americ. p. 174, 1879).

This species appears to be the largest known Nitella, collected by Dr. Ravenel in the "Santee Canal" South Carolina, in 1853, a few specimens of which exist in the collections of Engelmann (Missouri Botanical Garden), Gray, at Cambridge, Mass., and of Braun, in Berlin; also collected by Lindheimer in Texas, summers of 1847 and 1848, "in three creeks between the upper Guadaloupe and Pierdenales, often at a depth of ten feet."

The stems attain a diameter of 2 to 3 mm. and a length of several feet (4 to 6 or more). The internodal cells are often 6 to 8 inches long, the nodes bearing verticils of long sterile leaves, which below are nearly as large and long as the stems, becoming smaller above. The leaves are simple and terminate abruptly in a mucroniform point. Braun in his "Fragmenta" states that the young leaves terminate in a cluster of minute short leaves which are not readily noticed, and which fall off when old; the accompanying cut is copied from his figure. I have not observed these minute terminal leaflets, partly due, perhaps, to a desire to avoid mutilating the few specimens I have been able to examine. From the upper verticils, pedicils arise which bear verticils of minute leaves which are once divided and bear both *antheridia* and *sporophydia*; the pedicil abruptly diminishes as the first verticil of fertile leaves appears, and from that point to the tip of the fruiting part the plant is enveloped in jelly; see Fig. 2. The fertile verticils are usually four in number, and each consists of eight leaves which are once divided; the first segment is quite short, about 150 in diameter; the terminal segments, three in number, acuminate and sharply pointed, overtop the fruiting organs; there is an antheridium and a single sporophydium at the node of each leaf. The oospore is black with 6 or 7 rather prominent and sharp ridges, 500 to 560 long and of the same breadth; it surface is covered, when mature, by fibres, matted like felt. The antheridia are 360 in diameter.

In addition to the localities named we must mention *Mobile Bay*, at the mouth of the river, from which some sterile fragments have been sent by Mr. Chr. Mohr; it is presumed that they belong to this species, for no other large species belonging to this division is known. This species is to be looked for in our Southern fresh waters; the old station, "Santee Canal," is destroyed by the closing of the canal; Lindheimer's station is to be examined again shortly, we trust.

Explanation of Plate.—Figs. 1 and 2, plant reduced; Fig. 3, a section of the fruiting "spike," showing a fertile verticil with young fruit; Fig. 4, a mature leaf-tip; Fig. 5, an oospore; Fig. 6, a section of the shell of a mature spore (diagrammatic), highly magnified.

NITELLA CLAVATA (Bertero) A. Br., Char. Aust. Hook. Journ. 1, 1849; name only; Chara clavata Bertero, Coll. No. 117; also, Gay, Hist. fisica y politica de chile, par Claudio g., Botanica, tomo sexto p. 551, 1853. N. clavata Kuetz. Tab. phyc. VII. t. 81, 1857.

This species, first founded on South American specimens, has become fully elucidated by means of its many forms, which have been found from Uruguay, Chili, Mexico and California, to British America. It is essentially a Pacific Coast species.

Stems, usually densely tufted, varying from a few inches to over a foot in length; the lower portion elongated, while the upper verticils become crowded and densely tufted.

The verticils consist of two sorts of leaves (see Fig. 2) the one, 3 to 6, or even 8 in number, once divided into 3, rarely 5, terminals and bearing, when fertile, fruit; the other sort of "leaves" (consult Part 1, p. 23) consists of simple, undivided leaflets, situated between those of the first sort, not always of the same number.

The leaves of the upper verticils become fertile and bear an apical antheridium and lateral oogonia, usually three in number. The oospore, from 300 to 470 long and from 300 to 420 broad, is marked by 6 or 7 prominent and sharp ridges; the surface is minutely roughened, granular (in some specimens the roughened surface can be distinguished only by the best lenses, for example, a $\frac{1}{16}$ oil immersion is sometimes required.) Antheridia 300 to 400 in diameter.

VAR. INFLATA, A. Br., Herb. 1863; *N. Pottsii*, Seeman in lit., 1855 (N. capitata Potts); *N. clavata var. Muelleri*, Schaffner, in sced. 1856, flor. mex. ined.

This variety is characterized by the enormously inflated leaves, so that the fertile verticils look like small balls 5 mm. in diameter, the leaflets about 2 mm. long by 1½ mm. broad; the supplementary, sterile leaflets are often wanting and the oogonia often stipitate; the oospore may have eight angles.

This typical Pacific coast species is met with from Uruguay and Chili to British America. It is very variable as to size and size of the oospore. There seems in most forms to be a decided tendency to dilatation of the leaves, but in all forms wherever found the surface of of the oospore is very minutely granular. The stations reported in the Braun-Nordstedt "Fragmenta" are Orizaba, Mexico, Mueller, 1853; Big Sandy River, Missouri Plains, Fendler, 1849; Monterey, Cal., Bolander, 1865; Basin San Francisco Water Works, Bolander, 1865; Mexican boundary, Coppermine Creek, southern New Mexico, west of the Rio Grande, Wright, 1851–2; the *var. inflata*, near Tacubaya, near the City of Mexico, Schaffner, 1854, and in ditches near Chapultepec, Potts, 1854.

In addition I have received specimens from Sauvies Island, Oregon, J. and T. J. Lowell, 1882; San Catalina Island (var. inflata), Brandegee, May, 1890; Sand Coulee, Montana, August, 1891 ; Lake Merced, near San Francisco, ; San Luis Potosi, Mexico, September, 1890, Pringle.

In Uruguay the species was collected in 1839 by Gaudichand and Twedie; in Buenos Ayres; in Argentina; in Cordova; Bolivia, etc. Spegazzini reports a var. laguroides from Uruguay, but the specimens distributed by Migula, Sydow and Wahlstedt, No. 26, do not differ from other collections, notably those from Mexico by Pringle; the verticils are remote and contracted, a not uncommon form hardly characteristic of a variety. His "var." *zonata*, also from Uruguay, is a form with zonular incrustation, frequently noticed in collections of many species of Nitella and naked-stemmed charæ.

The specimens from Oregon bear oospores averaging 440 long by 410 broad; those from Montana 340 long by 306 and even 260 broad; from Oregon, 7–8 ridges; from Montana, 6 ridges—all minutely granular.

Plate.—Fig. 1, portions of fertile verticil × 25; Fig. 2, copied from Braun-Nordstedt Fragmenta an upper view of a verticil, showing two sorts of leaves; Fig. 3, an oospore × 50.

NITELLA DILATATA, sp. nov.

Plants diffusely branched 6 to 10 inches long; stems 1 to 2 mm. in diameter; lower verticils consist of 6 leaves which are at times simple, at times once divided; but without any "adventitious" leaflets, hence *falsly heterophyllus*; fertile verticils contracted to dense masses, like "heads," long over-topped by the more slender fertile leaves; leaves of the fertile verticils all once divided, the terminal leaflets, in number 2 to 5, usually 3, somewhat inflated below, tapering above to a sharp

point rarely inflated above and abruptly pointed. Fruit at the divisions of the leaves, oogonia single or aggregated ; terminal cells of the coronula elongated; coronula evanescent; oospore 440 to 480 long, 360 to 375 broad with 6 or 7 angles which are not prominent, the surface perfectly smooth (even under the highest lenses). Antheridium 530–580 in diameter. The first division of the leaves is about 400 in diam. ; the dilated terminals are from 800 to 900 in diam. at the widest part.

This unique species, of which but few specimens exist, was sent by Prof. Macoun, of Canada, as having been collected by Mr. John Moser, at Canaan Forks, New Brunswick. Mr. Moser, however, when applied to had no recollection of having collected it, and has not been able to re-discover the plant, after careful search in that vicinity. It is possible that the locality may be wrong, since its appearance associates it with *N. clavata*, A. Br., and the explorations of the route of the Canadian Pacific may have brought the plant to light.

It is, however, quite distinct from *N. clavata*, A. Br., not only by apparently, but not truly belonging to the *hetrophyllæ*, but by the peculiarity of the coronula of the sporophydium and the peculiarities of the mature spore, which is larger and has a perfectly smooth surface (never seen in N. *clavata*, A. Br.).

Nitella Macounii, Allen ; Tolypella Macounii, Allen. Bull. Torrey Bot. Club, XIV., p. 212, plates 72 and 73, Nitella Macounii, Allen, idem XV., p. 11.

Plant small, 2 to 4 inches long, densely tufted and much branched. Stem about 250 in diam., bearing verticils consisting of about eight leaves. Leaves all divided, but dissimilar, part bear fertile nodes and are twice divided, the terminals being one-celled, a few do not bear nodes and consist of a long two-celled terminal. This same dissimilarity pertains at the first node of the leaf, which bears leaflets with a secondary node, and then a simple two-celled terminal. These two-celled terminals, whether springing from a stem-node or a leaf-node, are usually as long as or even longer than the other terminals. The first segment of the leaf is 190 to 200 in diam. ; the second, about 140 to 150 in diam. ; the terminals 120 in diam. ; and terminate abruptly in a sharp point. The last node of the leaf bears generally 3 to 4 terminals with an antheridium and two or three oogonia. The fertile leaves are usually but once or twice divided, while the sterile leaves are usually 2 to 3 times divided. Some ultimate nodes, especially the sterile leaves, bear four long terminals, all of which are two-celled, but the

ultimate cell is never a mucro. Oogonia aggregated, oospore 210 to 215 long, 200 to 210 broad, with 7 to 8 ridges, surface peculiarly marked by short elevations (see plate); these elevations are clearly seen with moderate lenses; they show on the edge of the spore like minute mountain peaks; they extend from the ridges at right angles a short way, and are irregularly distributed over the surface, but are always short.

This species was collected by Prof. John Macoun near Niagara Falls, and subsequently in Lake St. Clair.

Explanation of Plate.—Fig. 1, plant natural size; Fig. 2, fertile verticil × 25; Fig. 3, sterile verticil × 25; Fig. 4, oospore × 50; Fig. 5, surface of oospore highly magnified.

Nitella axillaris, A. Br., Characeen aus Columbien, Guyana und Mittelamerika, 1858.

Flexible, small; sterile verticils usually consisting of eight leaves, quite simple, elongated, their apices terminating in a minute crown of 4–5, very short, two celled leaflets; fertile verticils contracted in minute, sub-sessile axillary "heads," the leaves of which are mostly twice divided, the terminal segments two-celled, bearing an antheridium and oogonia which are often aggregated; coronula of the oogonium short and obtuse, nucleus ovate, sub-globose, *fuscus*, 7-striate 290–320 long; "membrane of oospore reticulated" Nordstedt. In stagnant pools near Caracas, March, 1854, *legit* Gollmer (Herb. A. Br.). The same species was collected by F. Mueller, near Orizaba, Mexico; in this form the stem is simple, or with only a few branches, about 1 mm. in diameter; the fruiting "heads" 1½ to 2 in diam., the terminal segments of the leaves 60 to 120 in diam.; the mucro 40 to 50 diam. at base, 100 to 120 long. A variety was collected in Java, near Batavia (Herb. van den Bock.), mixed with *acuminata v. Javanica* and *polyglochin v. Javanaca*, which varies from the American form in being more delicate with smaller, more completely sessile "heads" and smaller oogonia. This form carries also the minute crown of small terminal leaflets on the apex of the leaves.

The above description has been quoted from A. Braun, and the figures have been copied from the Braun-Nordstedt "Fragmente." The plants have not been seen by me.

Nitella Morongii, Allen, Bull. Torr. Bot. Club, XIV., p. 214.

Slender, 2 to 6 inches high; lower verticils consisting of long sterile leaves once or twice divided, terminating in a single mucronate cell; some of the sterile leaves appear to terminate in a node, as though terminal cells had dropped off, but we have not been able to

detect any cluster of terminal cells, as in the preceding species; and as some apices of the sterile leaves certainly terminate in a mucronate point, we take this to be a distinctive difference between these allied species; fresh plants must be examined to determine this matter with certainty. Upper verticils are fertile and condensed in terminal and axillary "heads," some of which are very minute, others forming dense clusters, 6 to 8 mm. in diameter. Leaves of the fertile verticils, 6, very short, once or twice divided (occasionally a third division will be noticed), first division 95 in diameter, terminals usually 4, or when the ultimate node bears fruit 3, consisting of two cells, the lower 460 long, 80 in diam., not inflated, the terminal cell, mucro, 45 broad at base, 140 long, tapering to a sharp point. Oogonia, usually on the ultimate nodes, solitary, coronula persistent. Oospore 250–260 long, 240–245 broad, with 5 prominent spirals; surface minutely granulated, according to Nordstedt "grumous like felt with knotty fibres" like *prælonga*. Antheridia 170 in diameter. The only collection of this species was made by the late Dr. Thos. Morong on the island of Nantucket, in July, 1887.

Explanation of Plate.—Fig. 1, plant, natural size; Fig. 2, portion of a fertile verticil × 25; Fig. 3, tip of a leaf × 50; Fig. 4, oospore × 50; Fig. 5, sections of membrane of spore, schematic, highly magnified. The Figs. 6–9 belong to N. axillaris.

NITELLA ANNULARIS, sp. nov.

Plants 6 to 8 inches long, branched and forming intricate masses; lower verticils consist usually of six sterile leaves which in the middle of the stem are often quite elongated, even exceeding the length of the stem; these are divided once or twice into two or three elongated segments, the tips of the sterile leaves are surmounted by a crown of three leaflets which are elongated and two-celled; the lower cell about 610 long, 290 broad the terminal (mucro) 200 long, 116 broad at base, tapering gradually to a sharp point. The fertile verticils are very much contracted and appear to terminate branches or peduncles from within the sterile verticils in the middle portion of the stem, or terminate the stems at the upper part, so that these "heads" are terminal. The fertile verticils are usually somewhat branched and consists of an axis with numerous whorls of fertile leaves; these fertile leaves, though short, are longer than the internodes of the axis, so that the fertile verticil appears quite dense; additional branches often arise within a fertile verticil, so that it becomes compound and often unilateral in appearance (see upper part of Fig. 1). The axis stem is here about 500 in diam. The fertile leaves are usually six, once divided, terminating in two or three ultimate, two-celled leaflets; the first segment of the leaves is 600

to 750 long, 200 to 225 broad; The terminal segment, including the mucro, 750 to 975 long, 100 broad; the mucro, or terminal cell, 170 long, 50 broad at base, tapering and sharp-pointed.

The most remarkable feature of this Nitella is the swollen and thickened nodes, both of stem and leaves. Owing apparently to this peculiarity the various segments of the leaves drop off very early, the mucro can be fonnd only on the youngest leaflets, the terminals of the leaves drop from the node of the leaf, leaving three (usually) prominent and thickened nodal cells (see Fig. 2), the leaves drop from the axis leaving a *ring of thickened nodal cells*, as at Fig. 2 (hence the specific name), these nodes persist on many of the older, almost naked stems, looking like thickened nodes in some species of *Polygonum*. In the younger parts of the plant the leaflets seem to *tear* off, leaving shreds of tissue around the swollen nodal cell, (see Fig. 4), in which the leaflets have dropped leaving a somewhat stipitate antheridium and a ring of tissue of the base of the leaflet around each nodal cell. It would seem that as the nodal cells thicken and enlarge the bases of the leaves become torn, not inflating as the cells swell. The same peculiarity is found in the sterile verticils, and it is rare to find a persistent crown of terminal leaflets on a sterile leaf.

The fruit is borne on the node of the leaf; the antheridium is somewhat stipitate and persists after the subtending leaflets have fallen, 520 in diam.; the oogonia, generally three in number at each node, seem to arise on one side of the leaflet; the coronula is evanescent; the oospore is nearly round, 280 long, 260 broad, with five striæ, and is minutely granular like that of N. Morongii, A. I have not been able to observe whether the surface is or not covered with "felted fibres."

This species was collected by *Mr. Pringle* in a "cold pool, Arroyo Ancho, Sierra Madre, of W. Chihuahua, October 8, 1888," in Mexico.

Nitella capitata (N.ab E.), Ag.

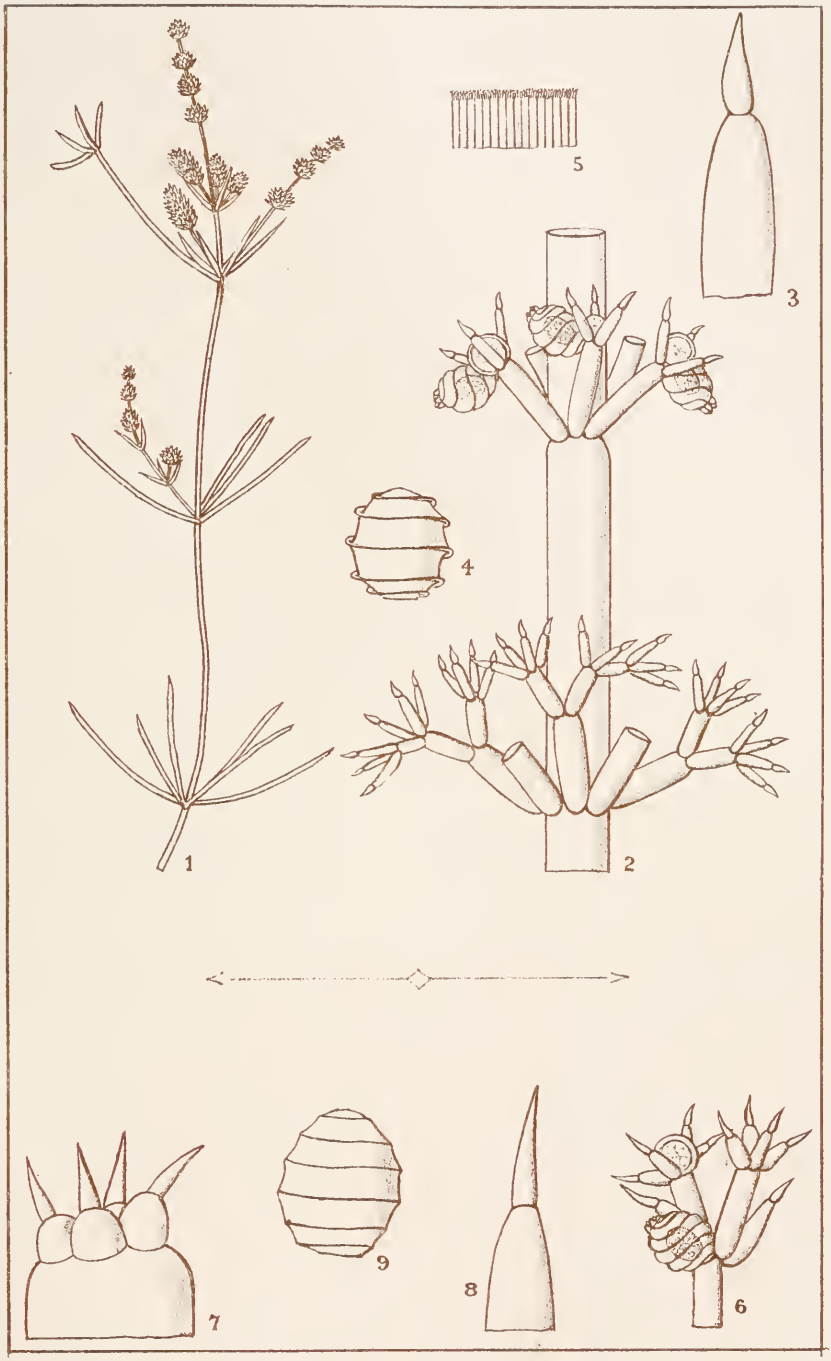
Nitella Bastini. Allen.

Nitella prelonga, A.Br.

Nitella clavata. A.Br.

Nitella dilatata, Allen.

Nitella Macounii, Allen.



Nitella Morongii, Allen Fig. 1-5.
Nitella axillaris, A.Br. " 6-9.

Nitella annularis, Allen.

The Characeae of America.

By Dr. T. F. ALLEN.

PART II.

FASICLE III.: CONTAINING DESCRIPTIONS AND ILLUSTRATIONS OF

NITELLA LEIBERGI SP. NOV.
NITELLA MUCRONATA A. BR.
NITELLA CAPITELLATA A. BR.
NITELLA GRACILIS (SMITH) AG.
NITELLA TENUISSIMA (DESV.) COSS. ET GERM.
NITELLA TRANSILIS SP. NOV.
NITELLA PYGMAEA A. BR.
NITELLA MINUTA ALLEN.
NITELLA INTERMEDIA NORDST.
NITELLA ASA-GRAEANA SCHAFFNER.

ISSUED APRIL, 1896.

MARINE BIOLOGICAL LABORATORY
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MASS.

3 Fruit on the first division only.
N. pygmæa, A. Br.

Synopsis, continued from page 9 (and completing the "*Macrodactylæ*" group.)

! ! DIFFUSA, fertile verticils not contracted "in dense axillary and terminal masses." **N. Leibergi**, Allen.

× × FLABELLATAE foliæ twice or more divided.

GYMNOCARPAE.*

1. *Fruit in all divisions of the leaves*, the last division sometimes excepted.
   + Oospore (nucleus) 270 to 380 long. **N. mucronata**, A. Br.
   + + Oospore 220 to 280 long.
      a, with five ridges, prominent. **N. capitellata**, A. Br.
      b, with six ridges, not prominent. **N. gracilis** (Smith), Ag.
      c, with seven or eight ridges, prominent. **N. transilis**, A.
2. Fruit in all divisions of the leaves, except the first division, which is sterile, usually.
   a, foliæ as long as or longer than the internodes, spreading. **N. transilis**, A.
   b, folia short, verticils compact, often moniliform. **N. tenuissima** (Desv.) Kütz.

* * GLOEOCARPAE. Fruit enveloped in mucous.

1. *Plants minute*, stem 130 in diam. **N. minuta**, A.
2. *Plants larger.*
   a. Diffusa, stem 300 to 450. **N. intermedia**, Nordst.
   b. Congesta, stem 400 to 750. **N. Asa-Graeana**, Schaffner.

NITELLA LEIBERGI, sp. nov.—*Nitella, diarthrodactyla, homoeophylla, monoica, macrodactyla, sub-flabellata (furcata) gymnocarpa, diffusa.*

Plants small, 3 to 4 cm. in height, diffusely branched. Stem 400 to 425 in diam. Verticils consist of six "leaves." The leaves, often heteromorphous (some simple undivided, others divided) once or twice divided; first segment 340 to 360 in diam.; first node, rarely fertile; second segment 220 to 268 in diam; second node usually fertile; third (terminal) segment 164 to 176 (125 to 135) in diam.; two celled. Terminal segments are usually four in number, as a rule undivided, but at times part or all of the terminals are again divided, the extra node bearing in turn four terminals. The ultimate cell, a mucro, is about 50 in diam. at the base, by 175 (135 to 185) long. The penultimate cell generally tapers somewhat from about its middle to the base of the mucro.

The antheridia are about 225 in diam. (vary from 200 to 300). The oogonia are isolated about 390 long, including the small and persistent coronula. The oospore (nucleus) averages 272 long by 175 to 240 broad, with six strong ridges; its surface is marked with fine gran-

ules (though, being immature, the character of the "Nordstedt markings" is somewhat doubtful).

These plants exhibit a marked tendency to the "congestae" section, though in but few of the plants are found decided condensations of the fruiting leaves.

This species was collected for the United States National Herbarium by J. B. Leiberg on June 30, 1894, in "shallow pools which dry up in middle summer, under and among the submerged *Artemisia* shrubs, near Button Springs, Lake Co., eastern Oregon. Alt. 1470 meters."

Explanation of Plate.—Fig. 1, plant, natural size; Fig. 2, a verticil and leaf × 25; Fig. 3, a spore × 50; Fig. 4, surface of spore, highly magnified.

N. MUCRONATA.—A. Br. (*N. flabellata* Kg.; *N. exilis* A. Br.).

Plants about medium size, strong and erect, freely branched, almost bushy in habit; color dark green, or even brownish; stems, numerous from a single root, 0.8 to 1 mm. in diam. Leaves six in a verticil, twice—or, when fertile, thrice—divided; terminal segments two (rarely three) celled, the ultimate cell consisting of a slender mucro. This terminal mucro is much smaller (three to eight times) than the preceding cell. In fruiting the plant is monoecious, and the fruit is not enveloped in mucus. The oogonia are usually single, rarely aggregated; the oospore (nucleus) is dark-brown or nearly black, with seven rather prominent and sharp ridges (spirals), 260 to 360 long; its surface is reticulated.

This plant has been found occasionally in this country, but it seems to be much more common in Europe. It is quite variable; in its slender and more delicate forms, approaching *N. gracilis* Ag., A. Braun distinguished three sub-species found in America, var. *tenuior* (*N. flabellata* Kuetz, *N. exilis* A. Br.), a slender form with isolated oogonia, with prominent striae on the nucleus, Cambridge, Mass., and Texas. Var. *virgata*, "robustior, longi-furcata," oospores aggregated, Merrimac River, N. H., "in Herb. Decaisne, coll. by Green" (*N. virgata* Wallm.): var. *pachygyra* from North Carolina and Texas. In Herb. Engelmann is the following note by A. Braun: "I considered this formerly as *Ch. Elliotti* (same as *Ch. capitata* Ell.), but find now that it is somewhat different from the Schweinitz specimen from Carolina, and Le Conte's from Georgia; it cannot be distinguished from the European *Ch. flabellata* A. Br.

Another specimen, "*N. Braunfels* Tex., collected by C. Wright, 1850, and also running water of the Leona," is labelled *N. flabellata* Kuetz, *Ch. exilis* A. Br., and subsequently re-named *N. oligospira* var. *Wrightii* A. Br. "near *N. mucrona-tenuior* or *flabellata*." A speci-

men from North Carolina is labelled by A. Br. "*N. mucronata-tenuior* (*N. flabellata* Kg., same as *Ch. Nidifica* Schw."

Var. *leiopyrena* (striae on the nucleus not prominent), reported from Virginia and from Mexico.

Migula, having studied the variations of this species, both wild and in cultivation, in Europe, concludes that they cannot be maintained as permanent sub-species.

The species seems to be hardy and to produce fruit early and freely. It is reported from scattering stations from Cambridge, Mass., to Oregon, and south to New Mexico.

Description of the Plate.—The drawings were made from a specimen (var. *tenuior*) gathered in Cambridge, Mass., and show rather long terminals. All the antheridia had fallen; the figures speak for themselves; Fig. 4 shows the reticulation of the surface of the spore-membrane. The mucro is larger than usual in this species; usually it is very slender.

NITELLA CAPETELLATA.—A. Br. in *Sill. Journ.*, 1844, p. 92, name ("sub-species, *N. Gracilis vel potius mucronatae*?"), *Ch. tenella* A. Br. olim (1836?) *Ch. Ellioti* A. Br. olim (1846), *Ch. capitellata* "Ell." in Herb. Martii (with no locality)? *Ch. capitata* Elliot, "Sketch of the Botany of South Carolina and Georgia," Vol. II. (1824), p. 516. As a matter of courtesy, by Schweinitz, this species was called *Ch. capitellata* Elliot, by which name it is recorded in my notice of the North American Characeae in *Silliman's Journal*. It transpires, however, that in Elliot's "Flora" there is no *capitellata*, but a *Ch. capitata* Elliot, a name which must be changed on account of the *Ch. capitata* of Nees, Meyen and others. Elliot describes it, on p. 516, as follows:

"Ch.? caule ramulisque teretibus, glabris, articulis foliosis, fructibus capitatis, bracteis bacca paulo longioribus. Stem submersed, floating, terete, glabrous, somewhat diaphanous; leaves in whorls, generally six, terete, very acute. Flowers (?) very numerous, collected in axillary heads, at first sessile, afterwards pedunculate. Braeteal leaves 4 (?), transparent, acute, a little longer than the fruit. Berry smooth, yellow. In this plant I have not been able to distinguish the anther nor any spiral striæ around the fruit.

"Dr. Schweinitz sends me from Salem, N. C., under the name of *Ch. nidifica*, a plant closely allied to this. It appears to be more lucid and to bear leaves more numerous and more slender.

"Grows in ditches. Common in the rice fields on the Ogeechee river, Georgia (collected by Le Conte, Herb. Richard, labelled *Ch. nidifica*, and herb. Zeyher, without locality.

"This plant is intermediate between *N. gracilis* and *syncarpa*. The branching is similar to *syncarpa*; it even forms "nests," but is much thinner and more delicate; even the main stem is very fine. The verticils consist of six long leaves, divided into 4–5 long terminals, each of which is divided above its middle. The leaves

of the nest-like fertile verticils are twice divided, first into 5 to 3 segments, then into 3 segments, the central portion often again divided above its center, the others undivided. The tips of the leaves are similar to *gracilis*, but gradually diminishing to the point, which is very sharp; oogonia single, about the size of the oospores of *syncarpa*, with fewest striæ of all; oospores black.

"Herb. Martius. L. v. Schweinitz sent a specimen in 1829 by the name of *Ch. capitellata* Ell., without locality. The small specimen is so similar to the one in Richard's collection, showing the same lack of the lower portion, that I believe it came from the same locality.

"The old specimens have been re examined, July, 1858. The terminal segments 90 to 111 in diam., mucro 100 to 120 long, 30 to 40 in diam. Entire oogonia 360 to 420 long, 270 to 300 broad, oospores 230 to 250 long, 190 to 200 broad, dark brown, with sharp angles. The size of the oospores corresponds rather to *N. gracilis* than to *mucronata* v. *flabellata*, but the oospores have fewer and sharper angles. The Brazilian *gracilis* collected by Weddell corresponds perfectly as to the oospores.

"A specimen from Texas, in Engelmann's herb., 'in clear springs and creeks west of Brazos on Mill creek (?), Lindheimer, March, 1844,' is imperfect, but quite similar."

I have quoted thus at length from Braun-Nordstedt's "fragmenta" that assistance may be given to the re-discovery of this interesting plant, as well as to make the records of American Characeae as complete as possible.

The illustrations have been copied from the figures in the "fragmenta."

N. GRACILIS (Smith) Ag.

Plant slender and elongated (not spreading and "bushy" like *mucronata*). The stems are freely branched, 8 to 12 cm. long and 3 to 5 mm. thick. The verticils consist of 5 or 6 leaves, which diverge from the stem, thus differing widely from *transilis* and *tenuissima* in appearance. The first segment of a leaf is about two-thirds the entire length of the whole leaf, 200 to 250 in diam.; it stands almost at right angles from the stem in the lower verticils; first node divides into 4 to 5 secondary divisions, which are half the length of the first, 170 to 200 in diam.; the second node (fertile) bears four tertiary divisions (terminals) shortest of all, 100 to 140 in diam.; *these are more frequently three-celled*, the lowest cell being usually about two-thirds the length of the entire segment. These terminals sometimes are again divided, the extra nodes bearing four long terminals. The terminal cell (mucro) is at base about two-thirds the diameter of the preceding cell at its end next the mucro, 25 in diam., 25 to 40 long. The penultimate cell seems to taper from its base to the base of the mucro.

Antheridia 220 to 250 in diameter. Oogonia isolated, *at every node of the leaf;* ocspore 220 to 275 long, 200 to 250 broad, with 6 to 7

striae not very prominent. its surface covered with a close felt "of knotted fibres" (*Nordstedt*).

The stem of this species is fine, 300 to 400 in diam. The leaves are longer and the verticils looser than in *tenuissima*, though in some of its contracted forms it resembles that species. In its diffuse, much branched habit, with open spreading verticils, it resembles *N. mucronata*, and differs from *N. tenuissima*. In the series of connecting forms standing between those species this (*gracilis*) stands next to *mucronata*.

It is not common in America. The specimen from which the drawing was made was gathered in Gorham, New Hampshire, by Prof. Farlow; it is reported also from Canada (Engelmann) and Texas (Lindheimer).

A form collected many years since in Louisiana by Josiah Hale and found in the herbaria of Engelmann, St. Louis, and Gray, Cambridge, bearing the name "*Chara foliosa*," must be referred to this species as forma *divaricata* Migula. It has the following characters: Stem elongated, 415 in diameter, simple, bearing remote verticils. Verticils consist of six leaves, the *first segment* of which is half the length of the whole leaf (entire leaf about 15 mm. long, to tip of mucro), 150 to 170 in diameter. The *first node* bears six divisions, and is usually sterile; *second segments* 75 to 85 in diameter. The second node bears 4 or 5 divisions and is fertile; the third segments are 55 in diameter. The third node bears 4 divisions and is fertile; the fourth segments are 40 to 45 in diameter, and taper to about 35 at the upper end of the penultimate cell. The terminals, 2 or 3 in number, are quite long and usually 3-celled; they bear sometimes a fourth node, which is rarely fertile and in turn carries 2 to 3 secondary terminals. The terminal cell, a mucro, is about 25 in diameter at base and 60 to 65 long.

The oogonia are isolated at the second and third nodes of the leaves, the oospore 260 long by 220 broad (those seen were too immature to determine the character of the Nordstedt markings). Antheridia 180 in diam.

Transitional forms between *gracilis* and *tenuissima*.

Several collections have brought to light forms which, while very similar to each other, cannot be referred either to *gracilis* or *tenuissima*. Like the latter, the stems are usually tufted from one root and quite simple. Like the former, the leaves are long and delicate, not divaricate, at times longer than the internode and overlapping the adjoining verticil. The characteristics of specimens from four widely different localities are so similar that I am persuaded, for the sake of convenience, to give them a name.

BIOLOGICA

NITELLA TRANSILIS, sp. nov. (*N. tenuissima* var. *longifolia* Allen, in *Characeae Exsiccatae Americanae.*)

Plants simple, tufted, 5 to 10 cm. high, rarely branched. Stem slender 125–130 in diam. Verticils about 8 mm. distant (in central portions of stem), not becoming condensed above. Leaves 6–7 mm. long (the verticils rarely overlapping, even at apex of stem). Verticils consist of five or six leaves. Leaf, first segment 80–100 in diam; first node sterile, of six divisions; second segment 50 to 60 in diam.; second node fertile, bearing six divisions; third segment 40–50 in diam.; third node, often fertile, bears 3–4 terminals, terminals not 3-celled like *gracilis*, 40–50 in diam.; mucro 20 in diam. at base, 60–70 long.

Oogonia isolated at second (rarely at third) node of the leaf. Oospore *272 long with 7–8 somewhat prominent striae* (varies 272 to 285 long, 245 to 265 broad, with 8 striae). The Nordstedt markings on the spore membrane vary. In specimens collected by John Robinson in "Chebacco Pond," Mass., the spore membrane is perfectly smooth; from Sparta Pond, New Jersey, T. F. Allen, mature oospores show minute points, almost conical, on the outer membrane, while the middle membrane is reticulated. In specimens from Rhode Island, T. F. Allen, the mature oospore membrane is reticulated. In some features it seems to approach the rare *N. confervacea* Breb., from Normandy (which I have not been able to obtain). From *N. gracilis* it differs by the presence of fruit on the second node of the leaf, never on the first (*confervacea* is said to be fertile at the first node), by the simple character of the terminals and by the Nordstedt markings. From *tenuissima* similar differences distinguish it, though it seems to approach this more closely than *gracilis*.

NITELLA TENUISSIMA (Desv.) Coss. et Germ.

Plants very small, rarely more than a few inches high. Stems tufted, two to five from a single root. The very slender stems, 140 to 250 in diameter, spread widely, often reclining close to the ground. The stems bear six to eight whorls of leaves, which are remote in comparison with the length of the leaves, and usually are short and quite dense, rarely reaching over more than a third of the internode; in some forms the whorls of leaves are so short that the stems appear moniliform. The verticils consist of six leaves which are three or rarely four times divided. The first segment is rarely over 75 in diameter, with quite thick cell-walls, and about one-third the length of the entire leaf. The first node (usually sterile) carries six or seven rays; the second segments, about 50 in diam., a little more than half the length of the first

segment. The second node, usually fertile, carries five or six rays; the third segments are about 50 in diam., and about half the length of the second; at times undivided rays spring from the second node (heteromorpha). The third node bears three or (usually) four terminal rays (occasionally some of these terminals are again divided). The fourth, or terminal, segments (usually four in number) are longer than the preceding, about 40 in diam., and are two-celled. The ultimate cell, a mucro, is slender, 15 to 20 broad at base and 70 to 75 long.

The plant is monoecious, the oogonia are single at the second and third nodes, rarely on the first node. The antheridium is 130 to 200 in diam., often somewhat stipitate; the mature spore varies between 175 and 306 long, 204 to 285 broad, reddish brown, with seven strong thin ridges; the surface marked by reticulae, or rather under high amplification the surface seems to be deeply pitted with irregular pits, while the surface seems uneven; the margins of the ridges overhang and seem to be "jagged."

This species varies considerably. Most frequently we find long-leaved forms more slender and with thinner cell-walls, often a moniliform variety, and also more dense and thick-walled forms. Among the latter is one collected by Dr. Rowlee, of Cornell University, in Mud Lake, New York; the stems were 127 thick, the segments of the leaves 190, 102 and 88 respectively, and the mucro 30 in diam. at base and 41 long. In addition it is *freely heteromorphous*, simple undivided rays are borne on every node and extend the entire length of the divided leaf; the leaves are at times only *once* or *twice* divided, the oospore 306 long by 285 broad. When the leaves are but once or twice divided one may often find five undivided terminals from the second node. The long-leaved and "major" forms of this species approach the intermediate species which I have hesitatingly created between this species and *gracilis* (*transilis*).

In that species, however, the oospore has eight ridges and its surface is smooth, reticulated, or even covered with minute elevations; the ultimate node is also fertile; the mucro is relatively much stouter and shorter, 20 to 27 broad and 60 to 68 long; still transition forms occur along the way toward *gracilis*.

A distinct variety is found in Cuba, Texas and other tropical countries in America, var. *compacta* A. Br., very low and much branched, forming a thick, turf-like mass. Leaves twice divided. The mucro falls easily, and is usually missing from the older leaves. Nuclei 200 to 220 long by 150 or 180 broad. A. Braun also distinguished a *forma domingensis* of the variety, oospore with six not prominent lines 220 long by 200 to 210 broad. In all its forms the surface of the mature oospore is reticulated, the reticulae 4 to 10 in diam.

Plate.—The figures on the plate represent as follows: Fig. 1, ordinary form; Fig. 2, f. compacta; Fig. 3, a portion of a leaf × 50. Fig. 4, mature oospore; Fig. 5 fragments of the spore membrane, showing reticulations like faint depressions in the surface, the surface in general being very indistinctly roughened.

NITELLA PYGMAEA A. Br.—A small plant (one or two inches long), dark gray.

The stems arise from one or two swollen leafless nodes, and produce, at first, usually two spreading verticils, consisting of longish leaves; afterward there arises a series of several short-leaved, contracted verticils. From the sterile and lower fertile whorls two (usually) unequal branches arise, which produce similar "capitulae." A verticil bears six leaves, equally twice divided, in fertile whorls partly thrice divided. In the second node there is often an undivided ray (leaflet). In the sterile leaves the first segment is twice as long as the second, the third likewise longer than the succeeding, the second and third equal in length. The terminal ray one-celled, except the mucro, which is smaller than the preceding cell, similar to *batrachosperma*, to which it is in its general appearance more similar than to *tenuissima;* yet, in spite of its minuteness, it is stouter than *N. batrachosperma*. Stem 480 to 500 in diam.; first segment of the leaf 360 to 380, second 260 to 280, third 180 to 200 (in the upper verticil 120 to 140). Mucro 60 to 70 long, 20 to scarcely 30 in diam. Antheridia and oogonia *on the first node only*, aggregated (two to three, usually two oogonia and one antheridinm). Antheridia 240 to 250 in diam. Entire oogonium 340 to 360 long, 280 to 300 broad; oospore yellowish brown, with 7 ridges, 250 long, 210 broad (larger than *tenuissima* and differing from *batrachasforma* by its ridges, *not prominent*).

Figures (on plate, with minuta) and description, copied from Braun-Norstedt Fragmenta; specimens not seen.

NITELLA MINUTA A. Characeae, Amer. Exsiccatae, No. 34.

This is one of the most minute *Nitellae*, rivalling *N. batrachosperma* A. Br. in smallness. Stem from 2 to 6 cm. in length, about 130 in diam. The leaves of the sterile verticils spreading, very small, filiform. Leaves of the fertile verticils condensed into small globular masses, enveloped in jelly, long-overtopped by the sterile leaves. Fertile leaves twice divided; first segment 104 in diam., about 460 long; first node fertile, bearing four rays; second segment 80 in diam., about 440 long; second node fertile, bearing three terminals; terminals 30 in diam., about 800 long, terminating in a mucro which is 30 in diam. at base and about 120 long. Oogonia single at each node of the leaf; oospores 350 long, 285 broad with six thick and prominent ridges, its surface marked by roundish elevations or granules. (See Fig. 5.)

This minute *Nitella* was collected in Green Pond, New Jersey, in 1883, and distributed in my American exsiccatae as No. 34. Its only near relative is *N. batrachosperma* A. B., of Europe, from which it is easily distinguished by many differences. A form of this species (which I had considered to be the true *batrachosperma*) was collected in Nantucket, Mass., by the late Dr. Morong. It is, however, essentially different from that species, and perhaps also from this; for the present, and until mature spores can be found and examined, I must consider it a form of *minuta;* it differs, however, in the greater size of the stems and leaves and the apparent partial inflation of the latter; its oospores are also much smaller. Its stems are 220 in diam.; leaves, first segment 150 in diam., 340 long; second segment 102 in diam., 340 long; terminals two to four in number, 122 in diam., 850 to 1000 long; mucro 34 in diam. at base, 122 long. Oogonia single at each of the two nodes of the leaf, 156 long, 136 broad. Thus it will be seen that the plant itself is larger, while the oospores are much smaller.*

The membrane of the oospore of *minuta* is marked by "elongated granules," Nordstedt. If the illumination be not of the best an erroneous impression of the markings is obtained. It is a somewhat difficult object to determine clearly. Irregular, oval or elongated elevations are intended to be indicated by the etching (Fig. 5).

NITELLA INTERMEDIA Ndst.†

"*Eunitella, diarthrodactyla, homoeophylla, monoica, gloeocarpa.* Folia triplicato-divisa, verticilli conformes, laxi. Nucleus sporangii ater 0.36 mm. longus. Diam. antheridii 0.24 mm."

Diffuse, about 100 mm. high. Verticils loose, like *N. gracilis*, the younger enveloped in mucus, and consisting of 6 to 8 leaves, the lower leaves as long as 35 mm., the upper 15 to 20 mm., twice or in some rays thrice divided, rays of the first division 5 to 7, of the second 4 (1 to 5), of the third 3 (1 to 4); terminal segments (of the third division bicellular; of the second sometimes, but rarely tri-cellular) terminating, without being sensibly attenuated, in a narrow and elongated mucro. Sporangia, in every division of the leaf, solitary with a short coronula; nucleus broadly oval, blackish, with 8 striae not very prominent, the colored membrane densely granulo-punctate. Stem 300 diam.; leaf

* February, 1896.—A new examination convinces me that the Nantucket specimens are quite distinct both from *batrachosperma* and from *minuta;* lack of good material, however, prevents my describing a new species, for which the name *Maxceana* would be selected as indicating the locality.

† This description is mainly taken from Norstedt's original in his "De Algis et Characeis," Lund, 1889.

260 diam.; ultimate segments 40 to 45 diam.; mucro 20 to 25 diam. by 40 to 105 long.

This species differs from *N. tenuissima* by its mucus envelope, by the larger black nucleus, sporangia in each division of the leaf, and by its long loose leaves; from *N. batrachosperma*, by its size, its long loose leaves in many rays thrice divided, and by its larger antheridia; from *N. gracilis* by its mucus, by the larger black sporangium with more prominent striae and by the segments of the third division of the leaves not being three-celled; from *N. leptosoma*, *genuina*, by the loose conformable verticils of leaves (thrice divided) and by the inferior cell of the ultimate segments not being gradually attenuate; it is, moreover, distinct from all the above by the structure of the colored membrane of the nuclei of the sporangia.

In the plate the "natural size" figure was drawn from a fresh specimen, with the younger, fertile verticils enveloped in mucus.

Nitella Asagraeana Schaffner, in Herb. Farlow.

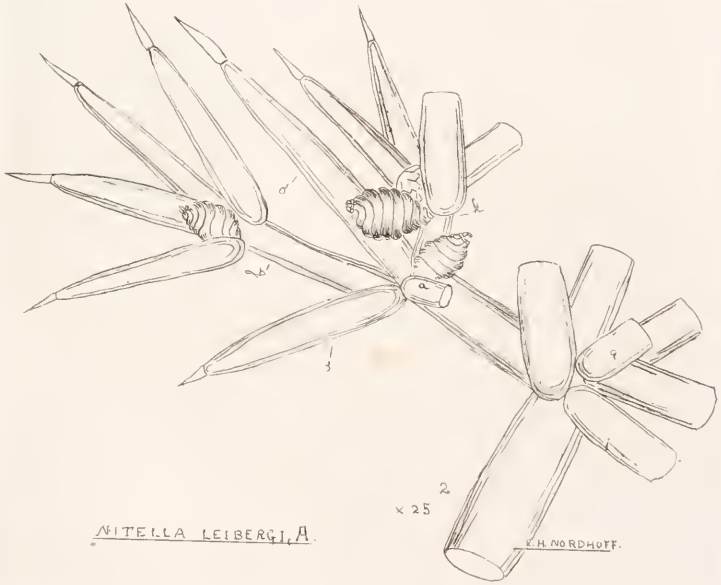
Plant 15 to 20 centimeters long, branched; lower verticils of five or six spreading, sterile leaves; upper verticils becoming rather suddenly condensed into close, interrupted, spike-like masses of fertile, contracted leaves, enveloped in mucus. The lower spreading leaves are about 20 to 30 mm. long, divided first into four short leaflets (2 to 5 mm. long), each of which is subdivided into three short terminals about half a mm. long, two-celled, terminating in sharp mucronate points. Diameters of sterile leaves: First segment 340, first division 265, terminals 125; mucro (which seems to be very evanescent, dropping easily and rarely found in older leaves), 48 at base, 115 to 120 long, very sharp. The upper sterile leaves are often partly fertile. The contracted fertile leaves are five (rarely six) in a verticil, once or twice divided; the terminal segments, two or three in number, terminate in a sharp mucro. The fruit is borne on both nodes of the leaf; isolated; the oospore 272 to 290 long, 175 to 190 (or even 230) broad, with five or six sharp and prominent spiral ridges; the surface grumous.

This plant was collected by Dr. J. G. Schaffner in 1876 in stagnant pools about Morales, near San Louis Potosi, Mexico, and appears in Herb. Farlow as No. 6 of his Flora Mexicana (exsiccatae?). The name is given as spelled on the original label. This original specimen is in a tangled condition, and could not be satisfactorily studied without injuring the plant (which is quite undesirable); new collections may possibly change somewhat the general description in minor particulars. The figures on the plate require no explanation further than to explain that a mass of mucus envelops the upper suddenly abbreviated fertile verticils.

NITELLA TRANSILIS R.

NITELLA GRACILIS (SMITH) AG.

C. H. NORDHOFF



NITELLA LEIBERGII A.

E. H. NORDHOFF.

NITELLA TENUISSIMA, (DESV.)